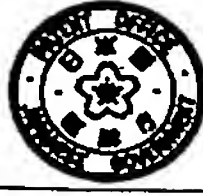


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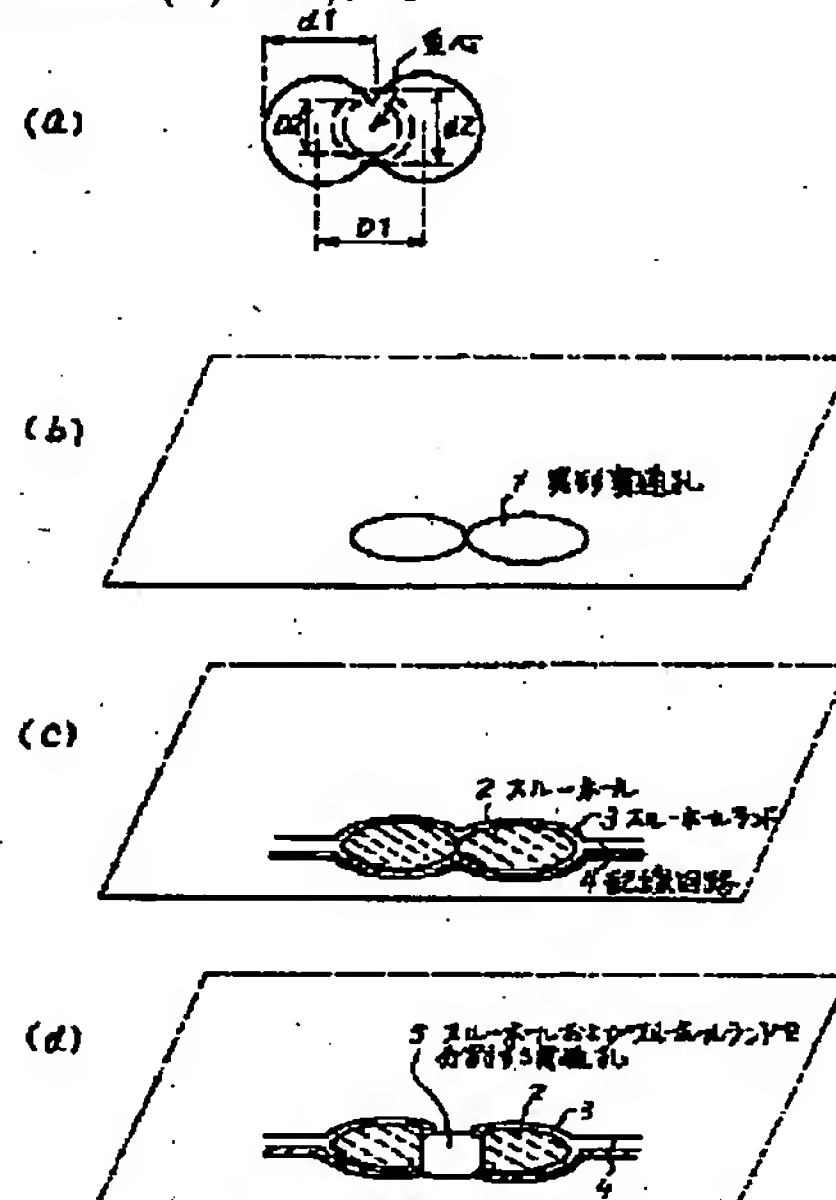
H05K 3/42(21) Application number: **08200640**(22) Date of filing: **30.07.96**(71) Applicant: **NEC TOYAMA LTD**(72) Inventor: **KAWAHARA TAKESHI****(54) METHOD FOR MANUFACTURING PRINTED WIRING BOARD****(57) Abstract:**

PROBLEM TO BE SOLVED: To realize a high density by reducing an area occupied by a through-hole for connecting front and rear circuits and inner layer circuit, in a method for manufacturing a high-density printed wiring board.

SOLUTION: A plurality of through-holes having the same diameter $d1$ are processed in such a manner that the same interval $D1$ of the respective through-holes becomes smaller than the hole diameter at desired places in copper laminated layers. Deformed through-holes 1 constituted with a plurality of circular arcs are made, and deformed through-holes plated with copper are formed on the whole surface of a board laminated with copper including inner walls of the deformed through-holes. Next, at the position of the center of gravity of the deformed through-hole, each through-hole having a diameter $d2$ smaller than $d1+D1$ and larger than the length $D2$ from the center of gravity to the intersection between a plurality of circular arcs is provided, also a through-hole 5 for driving through-hole land is provided, and a printed wiring board having

deformed through-holes with a plurality of front and rear passages can be obtained.

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Notes:

1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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CLAIMS

[Claim(s)]

[Claim 1] two or more arbitration is the same in the part of a request of copper clad laminate -- a path (d1) -- [a breakthrough is processed so that the spacing D1 of each of this breakthrough may become small and equal rather than a bore diameter (d1), and / process / which prepares the variant breakthrough which consists of two or more radii] The process which gives copper plating all over said copper clad laminate including this variant breakthrough wall, and forms a variant through hole, a through hole land, and a wiring circuit, The process which prepares the breakthrough which has the path (d2) which becomes small more greatly (d1+D1) than the die length (D2) by the intersection at which said two or more radii cross from this center-of-gravity location in the center-of-gravity location of this variant through hole, The manufacture method of the printed wired board characterized by having the process which divides said variant through hole, a through hole land, and a wiring circuit into at least two by this breakthrough.

[Claim 2] The manufacture method of the printed wired board according to claim 1 characterized by performing the process which prepares said breakthrough before the process which forms a variant through hole, a through hole land, and a wiring circuit.

[Claim 3] The manufacture method of the printed wired board according to claim 1 characterized by including the process to which the process which forms said variant through hole, a through hole land, and a wiring circuit applies a photosensitive resist layer.

[Claim 4] The manufacture method of the printed wired board characterized by including the process which coats solder resist after said variant through hole, a through hole land, and wiring circuit formation.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the manufacture method of a printed wired board of having the through hole for which the printed wired board of high density was suitable, about the manufacture method of a printed wired board.

[0002]

[Description of the Prior Art] A flow is obtained by the wiring circuit 4 of the through hole land 3

formed in the perimeter of the through hole 2 opened in the insulating substrates 10, such as epoxy, and a rear surface flow as the printed wired board which has a through hole conventionally is shown in drawing 7. Therefore, since the side-face perimeter of the through hole 2 is conductor-ized in this case, usually in one through hole 2, one rear surface conduction passage is taken. Therefore, proportionally, the number of wiring capacity of through holes 2 increases to increase, it is in the inclination which the size of the insulating substrate 10 enlarges, and is unsuitable to mounting of small size and a lightweight device.

[0003] Some methods of using a through hole 2 efficiently and realizing high density wiring according to the structure of having two or more rear surface conduction passages in one through hole 2, are proposed to such a technical problem. For example, in (1) JP,S59-10299,A, like drawing 8 (a), after forming the stellate breakthrough 7 in an insulating substrate, a through hole 2, the through hole land 3, and the wiring circuit 4 of a rear surface flow are formed by copper plating and etching like drawing 8 (b). Furthermore, by opening in the stellate through hole 2 the breakthrough 5 which divides a through hole and a through hole land like drawing 8 (c), one through hole 2 is divided and the method of forming as a through hole 2 which has two or more rear surface conduction passages is proposed. furthermore, like drawing 9 (b) after forming the circular breakthrough 8 like drawing 9 (a) by this well known example By forming a through hole 2, the through hole land 3, and the wiring circuit 4 of a rear surface flow, next making the stellate breakthrough 7 open and divide into a through hole 2 and the through hole land 3 like drawing 9 (c) One through hole 2 is divided and the method of forming as a through hole 2 which has two or more rear surface conduction passages is also proposed.

[0004] Furthermore, as other well-known examples [(2) JP,H4-64278,A] Like drawing 10 (b) like drawing 10 (a) after forming the circular breakthrough 8 in an insulating substrate A through hole 2, the through hole land 3, and the wiring circuit 4 of a rear surface flow are formed by copper plating and etching. Next, the breakthrough [land / 3 / a through hole 2 and / through hole] 9 using a small drill is opened like drawing 10 (c) and drawing 11 (a) - (c). The manufacture method of the printed wired board of having the through hole 2 which formed two or more rear surface conduction passages in one through hole 2 is also considered by making it divide.

[0005]

[Problem to be solved by the invention] In (1) of the conventional technology introduced previously, in order to prepare breakthroughs except circular, such as a star, the N/C perforator used for a circular through hole punching application cannot be used. Therefore, in order to process such a stellate variant hole, it is necessary using the metal mold according to each hole configuration to pierce with a die-press machine etc. and to process it. For this reason, for every substrate form, metal mold is needed and versatility is missing. Moreover, since clearance of powder is difficult at the time of processing of stellate details generate, the technical problem that the sex with plating of stellate details becomes an ununiformity at the time of conductor-izing of a through hole occurs.

[0006] When [moreover,] dividing a through hole 2 and a through hole land like drawing 11 (a) in (2) of conventional technology When using the breakthrough 9 using the minor diameter drill in which a path is smaller than a through hole 2 and the cut load concerning a drill is taken into consideration, a technical problem is on the aspect of affairs of quality, such as profitability and productivity, and also a drill crease.

[0007] When using the breakthrough of a path slightly smaller than a through hole 2, you have to stop moreover, having to prepare a breakthrough in which of the outside of a through hole 2, or the inside,

or a side. Like drawing 11 (b), when opening a breakthrough outside, the area which occupies the through hole which takes two or more rear surface conduction passages becomes large, and densification cannot be attained.

[0008] Moreover, since the conductor of two or more rear surface conduction passages 11 became thin like drawing 11 (c) when opening a breakthrough inside, when opening a breakthrough, the technical problem was in a quality side -- the rear surface conduction passage 11 separates.

[0009] The object of this invention is to offer the high density printed wired board which has the variant through hole formed with two or more radii, and the through hole which formed two or more rear surface conduction passages by making a part of through hole land remove and divide in one through hole.

[0010]

[Means for solving problem] the manufacture method of the printed wired board of this invention of two or more arbitration is the same in the part of a request of copper clad laminate -- a path (d1) -- [a breakthrough / the spacing D1 of each of this breakthrough] The process which prepares the variant breakthrough which processes it so that it may become small and equal rather than a bore diameter (d1), and consists of two or more radii, The process which gives copper plating all over said copper clad laminate including this variant breakthrough wall, and forms a variant through hole, a through hole land, and a wiring circuit, The process which prepares the breakthrough which has the path (d2) which becomes small more greatly (d1+D1) than the die length (D2) by the intersection at which said two or more radii cross from this center-of-gravity location in the center-of-gravity location of this variant through hole, It is characterized by having the process which divides said variant through hole, a through hole land, and a wiring circuit into at least two by this breakthrough.

[0011] According to this invention, two or more rear surface conduction passages 11 which have the area of the through hole 2 near about one one radii are formed by dividing the through hole 2 which consists of two or more radii beforehand conductor-sized like drawing 6 for every radii. When carrying out the split shape of two or more rear surface conduction passages 11 into a through hole 2, in order to process it with the path (D2) which certainly becomes large by spacing (D1) of a breakthrough from a bore diameter (d1), it becomes unnecessary moreover, to divide with the diameter of the minimum below a bore diameter (D1).

[0012]

[Mode for carrying out the invention] Next, the gestalt of operation of this invention is explained with reference to Drawings.

[0013] Drawing 1 (a) - (d) is the perspective view shown in principle drawing and process order explaining the manufacture method of the printed wired board of the gestalt operation of the 1st of this invention. [the manufacture method of the printed wired board of the gestalt operation of the 1st of this invention] Like drawing 1 (a), the physical relationship in the case of obtaining two rear surface conduction passages in one through hole forms the variant breakthrough 1 formed with two radii in the location where spacing (D1) of a breakthrough becomes small and equal from a bore diameter (d1) with a desired bore diameter (d1). Moreover, the location in which the breakthrough which divides the variant through hole formed with two radii is prepared is made into the middle point of the center to center of the circle of each bore diameter (d1), and the diameter of a breakthrough (d2) is taken as the path (d2) which becomes small more greatly (D1+D1) than the die length (D2) by the intersection at which radii cross. In addition, since it becomes impossible to divide a variant

through hole and the rear surface conduction passage of each radii flows if $D2 < d2$ are not satisfied, two rear surface conduction passages are not obtained in one through hole. Moreover, since all the rear surface conduction passages of a variant through hole will be similarly removed if $d2 < d1 + D1$ is not satisfied, a rear surface conduction passage is no longer obtained.

[0014] [conditions / said / the manufacture method at the time of considering it as the bore diameter ($d1$) of 1.0mm] like drawing 1 (b) After forming the variant breakthrough 1 formed in the copper clad laminate of 0.1-3.6mm of board thickness with two radii which become spacing of 1.0mm or less of a breakthrough ($D1$) with the bore diameter ($d1$) of 1.0mm, 5-30-micrometer copper plating is given all over the variant breakthrough 1 of said substrate, and conductor-ization of the whole substrate is attained. Furthermore, a 5-20-micrometer photosensitive resist layer is formed in the entire substrate including a through hole with electropainting. In addition, the method of forming a photosensitive resist layer by the laminating method, the roll coater method, or the dip coater method can also be used as the other methods. Next, the mask film which has a desired wiring circuit is contacted on said photosensitive resist layer, and it is 50 - 500 mJ/cm² at 300-400nm ultraviolet radiation. It exposes. The developer which removes said mask film and consists of 0.5-2Wt%Na₂ CO or the Na₂ SiO water solution of 25-35 degrees C of solution temperature in the back removes the resist layer c parts other than a desired wiring circuit. Acidity or an alkaline etching reagent removes a part for the exposed copper section like drawing 1 (c), and the photosensitive resist layer which remains with the 1-3wt%NaOH water solution of 40-55 degrees C of solution temperature is removed. then, the center-of-gravity location of the variant through hole formed with two radii like drawing 1 (d) -- that is, Are larger than the die length ($D2$) by the intersection at which radii cross at the middle point of the center to center of each circle which forms two radii. And ($d1 - D1$) the breakthrough 5 which divides the through hole and through hole of diameter [of 0.1mm or more less than 2.0mm] ($d2$) which become small is opened. The printed wired board which formed two rear surface conduction passages in one through hole is obtained by making a part of through hole 2 and through hole land 3 remove and divide.

[0015] drawing 2 (a) - (d) is the sectional view which looked like [principle drawing and process order explaining the manufacture method of the printed wired board of the gestalt operation of the 2nd of this invention], and was shown. [the manufacture method of the printed wired board of the gestalt operation of the 2nd of this invention] It becomes the physical relationship same like drawing 2 (a), also when obtaining three rear surface conduction passages in one through hole as the gestalt of the 1st operation. The manufacture method at the time of considering it as the bore diameter ($d1$) of 1.0mm forms the variant breakthrough 1 formed like drawing 2 (b) with three radii which become spacing of 1.0mm or less of a breakthrough ($D1$) with the bore diameter ($d1$) of 1.0mm. Then, conductor-ization of the whole substrate is performed like the gestalt of the 1st operation, and a photosensitive resist layer is formed. Next, an etching reagent removes a part for the exposed copper section like drawing 2 (c), and the photosensitive resist layer which remains by exfoliation processing is removed. furthermore, the center-of-gravity location of the variant through hole formed with three radii like drawing 2 (d) -- that is, Are larger than the die length ($D2$) by the intersection at which radii cross the triangular center-of-gravity location to which the center to center of each circle which forms three radii is connected. And ($d1 + D1$) the breakthrough 5 which divides the through hole and through hole land of diameter [of 0.6mm or more less than 2.0mm] ($d2$) which become small is opened. The printed wired board which formed three rear surface conduction passages in one through hole is obtained by

making a part of through hole 2 and through hole land 3 remove and divide.

[0016] Drawing 3 (a) - (d) is the perspective view shown in principle drawing and process order explaining the manufacture method of the printed wired board of the gestalt operation of the 3rd of this invention. [the manufacture method of the printed wired board of the gestalt operation of the 3rd of this invention] The variant breakthrough 1 formed with four radii which serve as the 1st, and the gestalt of operation of two and the same physical relationship like drawing 3 (a) also when obtaining four rear surface conduction passages in one through hole, and become spacing of 1.0mm or less of a breakthrough (D1) with the bore diameter (d1) of 1.0mm is formed. Then, conductor-ization of the whole substrate is performed like the gestalt of the 1st and operation of two, and a photosensitive resist layer is formed. Next, an etching reagent removes a part for the exposed copper section like drawing 3 (c), and the photosensitive resist layer which remains by exfoliation processing is removed. furthermore, the center-of-gravity location of the variant through hole formed with four radii like drawing 3 (d) -- that is, Are larger than the die length (D2) by the intersection at which radii cross the center-of-gravity location of the square to which the center to center of each circle which forms four radii is connected. And (d1+D1) the diameter [which becomes small / of 1.0mm or more less than 2.0mm] (d2) breakthrough 5 is opened, and the printed wired board which formed four rear surface conduction passages in one through hole is obtained by making a part of through hole 2 and through hole land 3 remove and divide.

[0017] Drawing 4 (a) - (c) is the perspective view shown in the process order explaining the manufacture method of the printed wired board of the gestalt operation of the 4th of this invention. The manufacture method of the printed wired board of the gestalt operation of the 4th of this invention forms the variant breakthrough 1 formed with two or more radii like drawing 4 (a) like the manufacture method of the printed wired board of the gestalt the 1-3rd operations, and performs conductor-ization of the whole substrate. Then, are larger than the die length (D2) by the intersection at which radii cross the center-of-gravity location of a variant through hole like drawing 4 (b). And (d1+D1) the breakthrough 5 which divides the through hole and through hole of a path (d2) which become small is opened, and a part of through hole 2 and through hole land 3 are made to remove and divide. Then, the printed wired board which formed two or more rear surface conduction passages in one through hole is obtained by removing the photosensitive resist layer which remains after clearance a part for the copper section which formed the photosensitive resist layer in said substrate, and was exposed to it with an etching reagent like drawing 4 (c). In addition, with the gestalt of this operation, it also becomes possible to reduce the copper weld flash generated when forming a through hole 2 and the breakthrough 5 which divides a through hole land before pattern formation.

[0018] Drawing 5 (a) - (c) is the perspective view shown in the process order explaining the manufacture method of the printed wired board of the gestalt operation of the 5th of this invention. The manufacture method of the printed wired board of the gestalt operation of the 5th of this invention forms the variant breakthrough 1 formed with two or more radii like drawing 5 (a) like the 1st - the manufacture method of the printed wired board of the 3rd gestalt operation, and forms a variant through hole. Then, after coating a through hole and a through hole land with solder resist 6 like drawing 5 (b) in said through hole, Are larger than the die length (D2) by the intersection at which radii cross drawing 5 (c) like in the center-of-gravity location of a variant through hole. And (d1+D1) the printed wired board which opened the breakthrough 5 which divides the through hole and through

hole land of a small path (d2), and formed two or more rear surface conduction passages by things in one through hole is obtained. In addition, with the gestalt of this operation, since the through hole 2 and the through hole land 3 are coated with solder resist, it also becomes possible to reduce the copper weld flash generated when preparing a breakthrough.

[0019]

[Effect of the Invention] As explained above, this invention is set to the manufacture method of a printed wired board. The variant through hole formed with two or more radii, While being able to obtain the high density printed wired board which has the through hole which formed two or more rear surface conduction passages by making a part of through hole land remove and divide in one through hole, the following effectiveness is expectable to the well-known example (JP,S59-10299,A) of conventional technology.

[0020] (1) Special Working Machinery Sub-Division equipment, such as the die press for forming a stellate breakthrough, is unnecessary, and the breakthrough which divides a variant breakthrough and a variant through hole can be processed with the same perforator.

[0021] (2) Breakthrough processing of a star is unnecessary, and in stellate details get [it / blocked], there is no generating of poor powder clearance.

[0022] (3) There is no generating of the defect with plating generated into stellate details. Moreover, the following effectiveness is expectable to the well-known example (JP,H4-64278,A) of conventional technology.

[0023] (1) Economy, production, and upgrading become more possible than a through hole can be divided easily from not using the breakthrough of a minor diameter.

[0024] (2) The area which a through hole occupies can be minimized.

[0025] (3) There is no generating of poor peeling of a rear surface conduction passage. Furthermore, the effectiveness that the copper weld flash generated the conventional well-known example (JP,S59-10299,A) and (JP,H4-64278,A) when it receives and a variant through hole is divided with the gestalt of the 4th and 5 operation can be reduced is acquired.

[Translation done.]